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(54) Title: METHOD AND SYSTEM FOR INTERACTIVE MOTION TRAINING AND A USER INTERFACE THEREFOR

(57) Abstract: The invention pertains to a method of condensing one or more three-dimensional, digitized animation motion sequences into a self-contained, digitized animation unit, and the computer based, interactive user-interface that displays it. The digitized animation motion sequences are actual moving images of an instructor dynamically performing particular techniques from a pre-written script using motion capture hardware and software. A digitized animation unit contains one or more digitized animation motion sequences condensed into a single, software computer data file. An animation unit also contains audio, text, static images, and one or more different views, or camera angles, of the same animation motion sequences. An interactive computer-based user-interface allows a student to display and control different aspects of the animation unit, such as frame rate of speed and camera views, on a properly configured computer connected to a communications network, the Internet, or television, or any hand-held computer communications device.

METHOD AND SYSTEM FOR INTERACTIVE MOTION TRAINING AND A USER INTERFACE THEREFOR

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of priority from the prior provisional application entitled "METHOD AND SYSTEM FOR INTERACTIVE MOTION TRAINING AND A USER INTERFACE THEREFOR", serial number 60/146,933, filed in the United States Patent and Trademark Office on July 30, 1999.

FIELD OF THE INVENTION

The present invention relates generally to a process for capturing three-dimensional motions of an instructor, actor or other demonstrator and converting the three-dimensional motion information into a three- or two-dimensional digital display format; developing a digital character including equipment such as clothing and gear appropriate for the motion being taught and having the same physical characteristics, height, weight, and shape of the instructor; dividing the full training motion sequence into individual motion segments; compressing the motion segments into a single, digitized software animation unit; and adding textual, audio or visual explanatory material associated with a particular motion segment to the animation unit. The present invention also relates generally to a computer software program that retrieves the animation unit from a remote file server or a local database or other location; and controls the animation unit to display the training motion, individual motion segments and/or the explanatory material on a display, or, for example, an Internet browser, television, or any hand-held or other computer device capable of running the software program and providing a display.

BACKGROUND OF THE INVENTION

Motion training is used to teach millions of people how to perform or perfect a new technique. The method of learning a motion most often employed by those seeking to learn new techniques is through self-education using books or videotapes or other

educational material. For example, students may purchase instructional books or video tapes to read or review the proper techniques performed by an instructor, and then proceed to perform the motions on their own using the guidelines provided by the material. These methods, however, are static and typically do not allow for the student to interact or control the way in which motions are displayed. Also, the student may not gain the benefit of seeing the same motion from different vantage points or camera views. Furthermore, for the average person, this process can be difficult and unrewarding because there is typically no review of whether the student's technique was performed accurately, and therefore often leads to students improperly learning the motions.

Motion training can also be taught by an instructor verbally directing the student to recognize the desired positions and sequence of the motions by imitation, feel and through the explanatory comments of the instructor. To receive the most money for their time, the instructor usually assembles a group of people, or class, and performs the techniques for many people at once. This method of learning can be too costly and time restrictive for the student as he or she is subject to the time schedule and location at which the instructor teaches the techniques. And, if the student wants to repeat any of the techniques with the instructor, or have the benefit of one-to-one instruction, an additional fee is charged to the student above and beyond the cost of the original lesson plans. Furthermore, the motions of the instructor are presented in one speed -- as quickly as the instructor naturally moves; in one temporal direction -- forward in time; and usually in one complete sequence. The segments or subsequences which may comprise the sequence of an activity are not easily viewed or separated by the instructor nor by a student viewing a live demonstration.

What is desired is a method and software system for training motions to a student which provides a digitally displayed character wearing appropriate equipment such as clothing and gear for the motion to be taught, where the character resembles an actual instructor who has performed the motion, possibly in accordance with sanctioned script instructions before a motion capture set up; and where the student may select individual motion segments comprising the complete motion sequence to display and redisplay along with explanatory material associated with that segment or subsequence; and where the student may select one of several camera angles for viewing the motion; and where the

student may select individual portions of the digital character display to view additional information related to that portion.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the present invention, a method and system are presented for condensing one or more three dimensional, digital animation motion sequences into a self-contained, digitized animation unit, and dividing the motion sequences into separate motion segments or subsequences associated with explanatory text, audio, graphic or other material; and for providing an interactive user-interface for displaying and controlling the animation unit. The separate motion segments or subsequences of the overall animation sequence may be played as individual self-contained units by a user, allowing a user to focus on one particular portion of a physical activity (*e.g.*, only the ball toss subsequence in a tennis serve sequence). The user may play such a subsequence so that the motion display starts at the beginning of the subsequence, and not before, and ends at the end of the subsequence, and not after. Further, explanatory material associated with that segment may only be presented while the user is viewing that motion segment. Thus other portions or subsequences of the animation do not interfere with the user's study of the subsequence.

The present invention provides for a method of capturing the dynamic motion techniques of an instructor performing a motion, preferably using a script sanctioned or approved by an appropriate organization, digitizing the motion into data files, superimposing a character graphic on the three-dimensional animation data, converting the data into three- or two-dimensional vector data, cleaning and filtering the animation data to smooth the appearance and highlight those portions of the character which are most relevant to instruction of the technique, dividing the motion sequence into individual motion segments, adding explanatory material associated with each individual segment, and efficiently delivering the animation unit to a student using an interactive control interface over a communication network, the Internet, television, or any hand-held computer device capable of running an interactive user interface for controlling the animation unit.

The present invention also provides for creating a simple, inexpensive and easy to use motion training user-interface, providing instructional information to a user, which displays a vector graphical representation or animation of a motion technique of an instructor who has correctly performed the motion sequence, and which also provides audio, text, or other material and Internet hyperlinks associated with one or more digitized motion segments or portions of the sequence, or associated with a portion of the digital character representation in an interactive environment. The software display program and user interface uses the animation unit as input. The animation unit may also include an entire course of training motion sequences performed by an instructor dynamically performing particular motion techniques.

The present invention further provides for a software display program or player, capable of displaying the motion techniques from an animation unit on an Internet browser, television, or any hand-held computer device capable of running the software player. The software player accepts and processes user input to control the digitized animation motion sequence, and individual motion segments, the speed of animation playback, and one or more different camera views of the same motion sequence. The software player typically also allows the user to display and review the animation motion sequences and individual segments to help the student isolate the different motions that make up the complete technique and provide additional explanatory material associated with certain portions of the display.

Accordingly, it is an important object of this invention to provide a method and system for interactive motion training including converting three dimensional training motion sequences performed by an instructor to three- or two- dimensional vector graphic data; including explanatory text, audio, graphical or other material associated with an individual motion segment of the training motion sequence; and providing an interactive user interface for displaying and controlling the training motion sequence and individual motion segments while viewing the explanatory material.

Another object of the invention is to provide a method and system for training a user to perform a motion sequence including a three- or two dimensional vector graphic representation of an instructor performing the motion sequence, and an interactive

user display allowing the user to select specific motion segments from the training motion sequence to review, which motion segments are associated with explanatory material also displayed on the user interface.

A further object of the invention is to provide a user interface for displaying three- or two- dimensional vector graphic representations of a training sequence and explanatory material associated with individual segments of the training sequence motion wherein the user may select one of several camera angles with which to view the motion segments, and may select individual portions of the representation whereby the user is shown additional information associated with that portion of the representation.

Still another object of the invention is to provide a user interface for displaying training motion sequences in which the user may select individual motion segments for display, may freeze, reverse or fast forward individual frames or a range of frames from the training motion sequence, and may view additional material associated with an individual frame or range of frames or associated with a user selected portion of the representation.

Still a further object of invention is to provide a digitized, sanctioned and approved motion training sequence as performed by an experienced instructor and explanatory materials associated with individual motion segments of the sequence; and a software program for controlling and displaying the sequence, whereby the student may control the camera angle for viewing the sequence, and a frame or range of frames comprising a portion of the training sequence or an individual motion segment.

Yet another object of the invention is to provide a user interface displaying an animation unit including individual motion segments forming a motion sequence; and displaying explanatory text associated with a frame or range of frames of the motion sequence; and further providing additional information, such as audio, graphic or other material, in response to user interaction.

Yet a further object of the invention is to provide a system and method for easily teaching a motion technique by allowing a student to view a motion sequence broken down into individual motion segments, wherein the motion sequence is generated from an instructor performing a script approved or sanctioned by an appropriate organization and

creating a vector graphic representation, and providing explanatory material associated with portions of the motion sequence.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the following detailed specification.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, the system embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, and the interface embodying features of construction, combinations of elements and arrangement of parts which are adapted to allow user interaction therewith, all as exemplified in the following detailed disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and its associated advantages, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram of the major elements of one implementation of the present invention;

Fig. 2A is a block diagram of the individual elements that make up the major element 102 in Fig. 1;

Fig. 2B is a block diagram of the individual elements that make up the major element 106 in Fig. 1;

Fig. 2C is a block diagram of the individual elements that make up the major element 110 in Fig. 1;

Fig. 2D is a block diagram of the individual elements that make up the major element 114 in Fig. 1;

Fig. 3 is a diagram illustrating the individual instructional segments that make up an animation sequence to be displayed on a monitor according to one embodiment of the present invention;

Fig. 4A is the main control user-interface illustrating a number of animation sequences, with level of expertise, as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 4B is the main control user-interface illustrating the product marketing introduction sequence as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 5A is the main control user-interface illustrating one frame of the starting segment of the animation motion sequence from a side view as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 5B is the main control user-interface illustrating another frame from the start segment of the animation motion sequence from a side view as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 5C is the main control user-interface illustrating a third frame from the start segment of the animation motion sequence from a side view as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 6 is the main control user-interface illustrating the last frame from the first individual instructional segment and highlighted areas of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 7A is the main control user-interface illustrating the last frame from the second individual instructional segment and highlighted area of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 7B is the main control user-interface illustrating the last frame from the second individual instructional segment and highlighted area of focus as it can be displayed on a monitor from a front camera view according to one embodiment of the present invention;

Fig. 8A is the main control user-interface illustrating the first frame from the third individual instructional segment as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 8B is the main control user-interface illustrating a latter frame from the third individual instructional segment as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 8C is the main control user-interface illustrating still a later frame from the third individual instructional segment as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 8D is the main control user-interface illustrating the last frame from the third individual instructional segment and highlighted areas of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 8E is the main control user-interface illustrating the last frame from the third individual instructional segment and highlighted areas of focus as it can be displayed on a monitor from a front camera view according to one embodiment of the present invention;

Fig. 9A is the main control user-interface illustrating the last frame of the final individual instructional segment and highlighted areas of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 9B is the main control user-interface illustrating the individual highlighted area of focus on the final individual instructional segment as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 9C is the main control user-interface illustrating another individual highlighted area of focus on the final individual instructional segment as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 10A is the main control user-interface illustrating the ending instructional segment as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 10B illustrates an additional instructional topic as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 10C illustrates another additional instructional topic as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 11A is the main control user-interface describing the equipment used for the instructional sport with highlighted areas of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention;

Fig. 11B illustrates the textual description for the individual highlighted area of focus for an equipment item used for the instructional sport as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 11C illustrates the textual description for an individual highlighted area of focus for another equipment item used for the instructional sport as it can be displayed on a monitor according to one embodiment of the present invention;

Fig. 12 is a block diagram illustrating the hierarchy and navigational flow for the instructional content according to one embodiment of the present invention;

Fig. 13 is a block diagram illustrating the individual components of the animation unit according to one embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following description, various aspects of the present invention will be described. For purposes of explanation, specific configurations and details are set forth in order to provide a thorough understanding of the present invention. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details. Furthermore, well known features may be omitted or in the description simplified in order not to obscure the present invention.

The present invention is utilized for providing instructional information including motion training techniques to a user; in particular, motion training for various sports, physical therapy, dance, workplace or recreational activities. The present invention is particularly useful in training a motion sequence in which the positions of the body and its limbs, as well as sport, therapy, work, or recreational equipment, are to be compared during the motion sequence and emulated by the student.

In a sporting activity, a participant who is trained in the proper motion technique may be able to improve his or her skill level or avoid an injury from performing a repetitive motion accurately. Physical therapy can be more effective when exercising a specific muscle needing therapy through a particular motion when that motion technique is performed correctly. In the workplace, a worker's safety may be protected or a gain in production efficiency may result from proper technique in performing a particular motion.

In many repetitive motion activities the larger muscles of the body typically do most of the work. Golf, tennis, baseball, football, basketball, running, and many physical therapies, to name a few, are based on fundamental movements and techniques that typically result from the correct positioning of the body as a whole. Correct motion technique and placement of the major body parts with respect to one another is of major importance to the successful completion of the intended action. Even where the perceived motion action (*i.e.*, throwing a baseball) is performed more by the joints or extremities than the larger body parts, it still is usually the proper sequence of movements of the large muscles of the body which bring the joints and extremities into correct alignment with the appropriate timing of execution.

In fact, for proper results in successfully performing the technique in many motions of sports such as golf, tennis, and baseball, where the object is to hit a ball and the like, it is actually more important for the extremities to be in relatively correct alignment, through proper positioning of the larger muscles of the body moving in ways that are subtly counterproductive to maximum impact. Incorrect motion existing solely in the movements of the joints and extremities (*i.e.*, poorly timed rolling of the forearms in a golf swing) is more clearly demonstrated to the student with the present invention, which can interactively focus on a particular portion of the movement unlike with books or videotapes. The

student can see the actual shapes of the limbs in question moving in concert with one another and can highlight, through interaction with the display as described further below, the position of the extremity. That is, because the motion display sequence has certain highlighted areas, the student viewing a segment or subsequence may focus on a detailed view of the portion of the display highlighted to learn the correct positioning.

Although the present invention will now be described with regard to a particular in-line skating stop, this is but one example. The present invention may also be used for, among other techniques, training strokes or serves in tennis, hitting or pitching in baseball, running, hitting a nail with a hammer, proper technique to pickup heavy objects, and the like. Furthermore, the system and method of the present invention may be used for training in any sort of physical activity, such as physical therapy or dance.

The following embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that structural, logical, and graphical changes may be made without departing from the spirit and scope of the present invention.

The approval of a governing body of representatives in the field in which the technique resides, or other appropriate organization, may be consulted and a sanctioned technique will be developed. A script may be written for an instructor who performs the technique in the approved way. When used herein, the term "instructor" may mean any person demonstrating a physical activity, and is not limited to a person who is a certified trainer or a professional in a given field.

Fig. 1 is a block diagram of the major elements of one implementation of the present invention. Referring to Fig. 1, in step 102, motion capture cameras surrounding the area of movement detect light reflecting from optical balls positioned on the instructor and motion capture software digitizes the three-dimensional movements into data points. In step 104, the software further generates HTR motion data from the data points captured. It is well known to capture the motion of an actor wearing devices such as optical balls or lights indicating the relative motion of the actor's body parts; other methods of motion capture may be used with the system and method of the present invention. The creation and use of HTR file data is well known.

In step 106, a three-dimensional character is created which typically includes all equipment, including equipment such as safety gear and clothing used by people who perform the motion technique, in a computer software program. The HTR motion data is applied to the three-dimensional character model, which creates a three-dimensional version of the motion sequence. To optimize the viewing of the motion sequences on an on-line interactive display such as a browser, an additional computer software program may be installed on the computer to allow the main software program to call individual functions of the install program. This type of linked program is known as a plug-in.

In step 108, a plug-in program is used to render the three-dimensional motion sequences into two-dimensional vector data. One example of such a computer software program is 3D Studio Max running on a Microsoft Windows operating system; other software programs or modules may be used. A preferred minimum configuration supporting such a program includes a 128 Mbytes of main memory and an Intel Pentium 333 MHz processor. Those skilled in the art will recognize, however, that other comparable hardware and software programs may be employed without diverting from the spirit or scope of the present invention. Furthermore, where bandwidth is not an issue, the invention may be performed using a three-dimensional representation.

In step 110, the two-dimensional vector data files are imported into a vector-based animation software program. One such software program is Macromedia's Flash development environment; other software programs may be used. In step 112, animation data is created, and in step 114 an interactive animation unit or an animation data file is created. The images are treated, which may include editing unwanted data points or distortion, making line fixes, and colorizing, among other processes. The images may also be registered to remove lateral motion. Thus, a clean, two-dimensional graphic representation of the instructor wearing appropriate equipment, such as clothing and gear for performing the motion technique, is created to form the animation unit. In alternate embodiments, any representation of the animation information, such as an animation data file or remotely accessible animation data, may be created for later viewing by a user.

Fig. 2A is a block diagram of the individual elements that make up the major element 102 in Fig. 1. Referring to Fig. 2A, in step 202 the MOCAP cameras are

set up. In step 204, the instructor is fitted with a MOCAP suit or other equipment facilitating motion capture. Preferably, the instructor is fitted with a body suit for capturing motion, such as one including light reflecting, optical balls, approximately 1 inch in diameter, placed on the suit at key joint locations such as the elbow, knee, neck, etc. In step 206, the instructor performs the physical activity in the motion capture environment, for example the approved motion techniques outlined in an approved script. If such a script is used, it may be written with the cooperation and approval of the governing body of representatives or other appropriate organization that have joined together to promote and grow the activity or sport. The script comprises the steps that the instructor performs to teach the particular technique in the said motion capture environment.

Preferably, the motion capture environment includes light sensitive, optical cameras, computer hardware and the software to control the environment, but may include other combinations of equipment. One example of such an environment is a system provided by Motion Analysis Corporation. Other systems and methods of capturing motion may be used. In alternate embodiments a sanctioned script need not be provided; for example, an actor or instructor may simply execute a physical activity, such as jumping rope or performing therapeutic exercises according to a physical therapy regimen. In step 208, motion data points are generated. In step 210, the system and software generates HTR motion data from the data points captured.

Fig. 2B is a block diagram of the individual elements that make up the major element 106 in Fig. 1. Referring to Fig. 2B, in step 212, a three-dimensional character is created. The character may correspond in physical likeness to the person whose image has been captured, or alternately may differ in such physical likeness. In step 214, HTR motion data is applied to the three-dimensional character model. In step 216, a 3-D motion sequence is generated. In step 218, vector graph data is rendered from the 3D motion sequence in known ways.

Fig. 2C is a block diagram of the individual elements that make up the major element 110 in Fig. 1. Referring to Fig. 2C, in step 220, the two-dimensional vector data files are imported into a vector-based animation software program. In step 222, the images

are colorized and smoothed. In step 224, the images are also registered to remove lateral motion.

Fig. 2D is a block diagram of the individual elements that make up the major element 114 in Fig. 1. Referring to Fig. 2D, in step 226 interactive interface controls are applied. In step 228 explanatory or other materials may be added. In step 230 the explanatory materials may be associated with the relevant segments. In step 232 hot links to the animation unit may be added to provide highlighted areas of the animation sequence display, and, preferably, additional explanatory materials are added. In step 234 the animation unit may be exported. The animation unit provides instructional information for a motion sequence to a user.

The motion technique sequence which is thus created may be divided into individual motion segments or subsequences, each which may correspond to portions of an approved script or to logical breaks in the motion sequence. For a given motion sequence to be taught, several individual motion segments may be performed in sequence. For example, segments may correspond to a person tossing a ball in the air, drawing a racquet back, moving the racquet to strike the ball, and following through with the racquet.

Explanatory materials, such as text, graphics, audio or other material may be associated with each motion segment. In addition, certain areas of the representation may be linked to additional content. For example, a typical Internet hyperlink may be used to associate a portion of the representation with such additional content. A user may indicate or request that more information is desired about an object (*e.g.*, a body part or a piece of clothing) shown in the animation by, for example, moving an on screen indicator, such as a cursor, over the object and possibly clicking on the object using, for example, a pointing device such as a mouse or trackball. Additional information, such as the name of the object or a brief description of the desired position of the object (*e.g.*, the ankle is angled inward), may appear if a user drags a pointer over the object. Clicking on the object may also display additional information -- for example, an opportunity to purchase the object if the object is an item of equipment. Methods of associating interactive information such as labels or hyperlinks with displayed images and objects are known.

In the example provided, if a user of the interactive training interface clicks on the in-line skates of the digital representation, that user might be brought to a Web site provided by a manufacturer of in-line skates who wishes to advertise. Alternatively, content explaining the correct fit for in-line skates or what features of performance a user should look for when purchasing in-line skates may be shown to the user.

In another example, involving a baseball pitch, a user may click on the throwing hand of the digital representation of the trainer. If the user clicks the hand at the beginning of the motion sequence the user may be shown a close-up of the grip of that hand around a baseball. If the user clicks the hand at the release point in the motion, the user may be shown a slow motion close-up of the wrist flick being taught at the release point. Of course, it will be readily apparent to those of ordinary skill of the art, that any sort of additional information content may be associated with portions or objects of the digital representation at any time during the motion sequence. Allowing a user to control which objects need expanded explanation filters and limits the amount of information provided to a user, allowing for more effective training. Such methods are not easily effected with more traditional physical training, such as live classes, videotapes or books.

The animation unit also includes control structures which allow the animation unit to be affected by the user interface. For example, an index may be provided in the animation unit which determines the start frame and stop frame of the individual motion segments or subsequences within the complete motion sequence and may associate those segments or subsequences with particular explanatory material or other content. Typically, the animation unit also contains additional control information for performing other functions, such as tracking a particular user's viewing of that animation unit and/or monitoring a user's progress through a number of individual motion sequences or subsequences which may be contained in a course of related lessons.

The interactive control interface template is a software program adapted to control the display of the animation unit. Therefore, it includes a portion for displaying the motion sequence. Additional video control functions will appear in the control interface template, typically arrayed and applied around the motion animation sequence viewing portion. Other content such as text, Internet hyper-links, additional still images, and audio

comprising, for example, explanatory material associated with each motion segment within the motion sequence, may be embedded into the interactive control interface, making a single, self-contained software program for playing any animation unit on a computer. In a preferred embodiment, the interactive interface works in conjunction with an Internet browser, and utilizes the internal functionality of the Internet browser to perform many of the display tasks and file management tasks such as retrieving the animation unit from a remote Internet Web Site. Of course, it will be easily appreciated by those of ordinary skill of the art, that the interactive interface can be adapted for use on any sort of computing system, such as a personal computing device having any sort of configuration, a television, a hand-held computer device, or any other device capable of running a software program and providing a display.

In one embodiment, the control user-interface contains software elements allowing the user to view the instruction techniques from several different views or camera angles. This allows the user to have the best vantage point for learning the motion technique being displayed. One example of benefiting from the ability to view different camera angles is the stride technique for in-line skating shown. In Fig. 5A, the stride motion technique is shown from the front view, where the user cannot view how far apart the instructor's legs are from each other, or how far out from the center of the instructor's body the legs are. By viewing the stride technique from a different camera angle, such as the front view in 7B, the user learns the proper leg positions preformed by the instructor.

Fig. 6 is the main control user-interface illustrating the last frame from the first individual instructional segment and highlighted areas of focus as it can be displayed on a monitor from a side camera view according to one embodiment of the present invention. Referring to Fig. 6, the control user-interface enhances the learning experience for the user by displaying visual cues, such as highlighting selected extremities on the instructor's body or equipment. For example, highlights may be applied to the animation sequence along the instructor's hands, knees, the bend in the elbows, or the position of the wrists. These visual cues provide the user with visual assistance in matching corresponding extremities or joints of the user's body as the motion dynamically progresses through the sequence.

Fig. 3 is a diagram illustrating the individual instructional segments that make up an animation sequence to be displayed on a monitor according to one embodiment of the present invention. Referring to Fig. 3, in step 302 the user begins the animated sequence. In step 304, the skater is shown skating continuously. In step 306, Step 1 of the animation sequence (corresponding to segment or subsequence 1) begins. In Step 308, the animation of the skater moves to dynamic ready position. In step 310, Step 2 of the animation sequence (corresponding to subsequence 2) begins. In step 312, the skater starts a right A-frame turn. In step 314, Step 3 of the animation sequence (corresponding to subsequence 3) begins. In step 316, the animated skater rotates its head, upper body, and right knee. In step 318, the animated skater applies pressure to the inside edge of the left skate. In step 322, Step 4 of the animation sequence (corresponding to subsequence 4) begins. In step 322 the animated skater pulls its heels together and stands to end the stop. In step 326 the animation sequence ends. Any individual subsequence may be animated, and the animation of such subsequences may be controlled by being played forwards, backwards, at various speeds, in stop frame form, or by using other methods. The user may play each subsequence without playing any other part of the overall animation, starting at the beginning of the subsequence and ending at the end of the subsequence.

For purposes of illustration, a user's interaction with the animation unit will now be described. The animation unit will be accessed by a software player which may show the animation sequence, individual segments, explanatory text and certain control and other interface elements on a computer monitor, for example, or as part of another computer program, such as a browser. It will be readily understood that other means for displaying and controlling the animation unit may be used.

With reference to Fig. 4A, a computer monitor shows an introductory page showing a topic 402, in this case, In-Line Skating Techniques, and subtopic 404, in this case, braking lessons. An active display panel 406 may show various animation sequences related to subtopic 404, for example, standard heel stop, cuff-activated heel stop and grass stop. The user may select a particular animation sequence by clicking on the appropriate portion of active display panel 406 to form a highlight portion 408. A static display panel 410 will typically show text associated with highlight portion 408 or other explanatory materials as described herein.

Typical control and navigation elements will also be provided, such as a home button 412, a back button 414 and a next button 416. Upon hitting next button 416, for example, the user may be shown additional introductory or explanatory materials related to highlight portion 408. In this case, active display panel 406 may show a live-action video, as shown in Fig. 4B, and static display panel 410 may provide additional information links 418, such as hyperlinks and the like, to additional explanatory materials. Selecting any of information links 418 may provide additional information to the user, either in static display panel 410, active display panel 406 or by opening an additional browser window, and the like.

After reviewing this additional material, the user will typically press next button 416 to enter the lesson itself.

Referring to Fig. 5A, each motion technique may be divided into a number of smaller, logical instructional units, segments or subsequences. This allows the student to have the ability to isolate an individual instructional segment and replay it using the slide control. The user can view an instructors' motion techniques against a moving background (*e.g.*, a wall or a traffic cone) to give the user the sense of the rate of speed of the image of the instructor as it performs the techniques. The user can control different aspects of the animation by a known software element such as a slide control 800 or another element. The user can view the entire motion technique or view the motion techniques one frame at a time. In one embodiment, each mark on the slide control 800 corresponds to one frame of the instructional animation. Preferably, the user can also control the frame rate of speed of the individual motion techniques with the slide control 800. As the animation proceeds, instructional information corresponding to the portion of the animation which is being displayed may be shown on a portion of the screen. Such instructional information may be included in the animation unit or animation file containing animation information.

Referring to Fig. 5A, active display panel 406 will show a looped animation segment associated with the start phase of the lesson. Static display panel 410 will show explanatory materials associated with the start phase of the lesson. The control interface will provide for separate camera angles to view the animation segment in active display panel 406, such as side view 420 and front view 422. Again, additional control buttons

linking to additional information may be provided, such as a see more button 424 and a hear more button 426. Also, typical motion control buttons may be provided, such as a rewind button 428, a pause button 430, a stop button 432 and a fast forward button 434. Fig. 5B and Fig. 5C show additional frames in the looped animation segment.

Static display panel 410 may include tabbed portions 436 providing direct access to individual segments of the sequence, for example, step one, shown in Fig. 6. In this case, static display panel 410 will show explanatory materials associated with the segment identified as step one and active display panel 406 will show only the frames of the animation sequence associated with that segment. The animated character shown in active display panel 406 may also show highlighted regions 438 which are links to additional information. Upon selecting a highlighted region 438, the user may be shown such additional information.

Fig. 7A shows the segment identified as step two from a side camera perspective, and Fig. 7B shows the same frame from a front camera perspective.

Fig. 8A shows the segment or subsequence identified as step 3, and in particular, the initial frame of that segment or subsequence. Slider 800 shows a segment frame region 802 associated with the frames of the segment or subsequence, and a frame marker 804 associated with the particular frame being shown. Fig. 8B and Fig. 8C show later frames of the segment, as shown by frame marker 804. Finally, Fig. 8D shows the final frame of the segment from a side camera perspective, and Fig. 8E shows the same frame from a front camera perspective. By interacting with slider 800, the user can select any specific frame from the segment for closer study, and by choosing different camera views, can see that frame from different perspectives.

Fig. 9A shows the segment identified as step four, with static display panel 410 displaying explanatory materials associated with that segment. Fig. 9B and Fig. 9C show additional explanatory material in static display panel 410 associated with the user selecting highlight regions 438.

Fig. 10A shows explanatory material associated with the end or completion of the lesson. In this case, static display panel 410 may also include additional information

links 418. Fig. 10B and Fig. 10C show additional explanatory material in active display panel 408 associated with additional information links 418.

The above-mentioned introductory page, shown in Fig. 4A, may also include links to information other than lessons, such as a link to equipment useful for that topic. Fig. 11A shows the explanatory material in static panel 410 for such information, and active display panel 408 will typically show the animation character, including highlight regions 438 which link to information, such as the information shown in Fig. 11B and in Fig. 11C.

In one embodiment of the system and method of the present invention, an animation software unit is made up of one or more instructional motion sequences or subsequences embedded into a software unit. A software element known as a drop-down or pick list allows the user to have control over which instructional lesson he or she wants to view and practice. Most students learn the basic fundamentals and then go on to learn the intermediate and advanced motion techniques at their own pace and time schedule. Fig. 12 is a block diagram illustrating the hierarchy and navigational flow for the instructional content according to one embodiment of the present invention. Referring to Fig. 12, in step 702, the user selects the "Lessons" option. From this step, the user may select a number of sports, for example in-line skating (704), golf (706), physical therapy (708) or other activities (710). If the user selects in-line skating (704), the user may be presented with a set of skills comprising in-line skating; for example braking (712), aggressive skating (714), or other options (716). If the user selects braking (712), the user may be presented with various types of braking lessons; for example the standard heel stop (718), the grass stop (720), the spin stop (722) or other methods of stopping (724).

Fig. 13 is a block diagram illustrating the individual components of the animation unit according to one embodiment of the present invention. Referring to Fig. 13, an animation unit (802) according to one embodiment of the present invention includes various files (804), including files containing general information (806) and motion sequence information (808). The motion sequence information (808) includes motion segments (810), which in turn comprises explanatory material (812) and animation frames (814). The explanatory material (812) and animation frames (814) are related and may be

operated to interact with each other. In other embodiments, an animation unit may be of different structures, and may include different data.

In an exemplary embodiment a software display program using the animation unit as an input provides a user interface allowing the user to view and control the animation contained within the animation unit. The software display program may interface with an Internet browser, television, or any hand-held computer device to display and control the animation. The software display program accepts and processes user input to control the digitized animation motion sequence, individual motion segments, the speed of animation playback, and one or more different camera views of the same motion sequence. The software display program may also allow a user to access the additional information provided with the animation by, for example, using a pointing device to manipulate a cursor to indicate an object for which additional information is desired.

Accordingly, the present invention provides a process for capturing three-dimensional motions of an instructor and converting the three-dimensional motion information into a three- or two-dimensional digital display format; developing a digital character including equipment appropriate for the motion being taught and having the same physical characteristics, height, weight, and shape of the instructor; dividing the full training motion sequence into individual motion segments; compressing the motion segments into a single, digitized software animation unit; and adding textual, audio or visual explanatory material associated with a particular motion segment to the animation unit. The present invention also relates generally to a computer software program that retrieves the animation unit from a remote file server or a local database or other location; and controls the animation unit to display the training motion, individual motion segments and/or the explanatory material on a display, or, for example, an Internet browser, television, or any hand-held or other computer device capable of running the software program and providing a display.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method and in the system set forth without departing from the spirit and scope of the invention, that it is intended that all matter

contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in the limiting sense. The present invention may be implemented in different manners and used with different applications.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of this scope of the invention which, as a matter of language, might be said to fall there between.

CLAIMS

What is claimed is:

1. A method of displaying to a user instructional information for a physical activity on a computing system, the method comprising:

displaying an animated sequence of a physical activity and associated explanatory material, the animated sequence being divided into a set of subsequences which may be displayed continuously as the animated sequence or individually as individual animated subsequences, the explanatory material being divided into a set of portions, each portion associated with one of the subsequences, the animated sequence including images of objects which may be selected by a user; and

while an object is selected by a user, displaying to that user additional information for that object.

2. The method of claim 1 further comprising allowing the user to select a subsequence and to display the selected subsequence and the associated portion of explanatory material such that the resulting animation display does not begin before the start of the selected subsequence and does not end after the end of the selected subsequence and unassociated portions of explanatory material are not shown.

3. The method of claim 1 wherein the selection of an object is effected by a user operating a pointing device to move a cursor over an object.

4. The method of claim 1 wherein the object is one of a representation of a human body part and a representation of an item of equipment.

5. The method of claim 1, comprising allowing a user to alter the camera angle at which the animated sequence is displayed.

6. The method of claim 1, comprising allowing a user to alter the speed of the display of the animated sequence.

7. The method of claim 1, comprising allowing a user to alter the time direction of the display of the animated sequence.

8. The method of claim 1, comprising providing information links in the explanatory material and displaying items of instructional information in response to the user's selection of the links.

9. The method of claim 1, wherein the physical activity to be performed is performed in accordance with a script and each subsequence is associated with a step in the script.

10. A system for displaying to a user instructional information for a physical activity, the system comprising:

a computer module for displaying an animated sequence of a physical activity and associated explanatory material, the animated sequence being divided into a set of subsequences which may be displayed continuously as the animated sequence or individually as individual animated subsequences, the explanatory material being divided into a set of portions, each portion associated with one of the subsequences, the animated sequence including images of objects which may be selected by a user; and

a computer module for receiving user input allowing a user to select an object and, while the object is selected, displaying additional information for that object.

11. The system of claim 10 wherein the computer module for receiving user input allows the user to select a subsequence and causes the computer module for displaying the animated sequence to display the selected subsequence and the associated portion of explanatory material such that the resulting animation display does not begin before the start of the selected subsequence and does not end after the end of the selected subsequence and unassociated portions of explanatory material are not shown.

12. The system of claim 10 wherein the selection of an object is effected by a user operating a pointing device to move a cursor over an object.

13. The system of claim 10 wherein the object is one of a representation of a human body part and a representation of an item of equipment.

14. The system of claim 10, wherein the user may alter the camera angle at which the animated sequence is displayed.

15. The system of claim 10, wherein the user may alter the speed of the display of the animated sequence.

16. The system of claim 10, wherein the user may alter the time direction of the display of animated sequence.

17. The system of claim 10, comprising an animation unit providing animation information to the computer module for displaying the animated sequence.

18. The system of claim 10, wherein the computer module for displaying an animated sequence may display information links in the explanatory material and may further display items of instructional information in response to the user's selection of the links and the computer module for receiving user input allows the user to select a link in the explanatory material.

19. A method of creating a training animation unit comprising:

recording a moving image sequence of a live person demonstrating a physical activity;

converting the moving image sequence into a series of datapoints representing the moving image sequence;

forming, from the firstseries of datapoints, an animation sequence corresponding to the moving image sequence;

forming, from the animation sequence, at least one vector data file;

registering the at least one vector data file to remove lateral motion; and

forming an animation data file including a training animation.

20. The method of claim 19, wherein the step of forming the animation sequence includes coloration and adding images of equipment.

21. The method of claim 19, wherein the step of forming the animation sequence includes the step of forming a three dimensional digital character.

22. The method of claim 19, comprising adding additional explanatory information to the animation data file, wherein the additional explanatory information may be displayed at the option of a user viewing the training animation.

23. The method of claim 22, wherein the additional information includes links which allow a user viewing the training animation to view further information.

24. The method of claim 19, wherein the animation data file includes selectable object representations and where a user viewing the training animation may view further information regarding a selected object by selecting such object while viewing the training animation.

25. The method of claim 22, wherein the additional information includes items of instructional information, each item of instructional information corresponding to a portion of the training animation.

26. The method of claim 19, wherein the training animation includes moving representations of an animated person.

27. The method of claim 26, wherein the animated person has the same characteristics as the live person demonstrating the physical activity.

28. The method of claim 19, wherein the training animation includes a plurality of views, each from a different viewpoint.

29. The method of claim 19, wherein the training animation data file is stored in a database.

30. A method of creating a training animation sequence comprising:

recording a live person demonstrating a physical activity and forming a series of datapoints corresponding to the demonstration;

forming, from the series of datapoints, an animation data set corresponding to the demonstration;

including in the animation data set additional information corresponding to certain objects animated in the animation data set; and

forming a training animation sequence from the animation data set.

31. The method of claim 30, wherein the step of forming the animation data set includes coloration and adding equipment.

32. The method of claim 30, wherein the step of forming the animation data set includes the step of forming a three dimensional digital character.

33. The method of claim 30, comprising adding additional information to the training animation sequence, wherein the additional information may be displayed at the option of a user viewing the training animation sequence.

34. The method of claim 33, wherein the additional information includes hyperlinks.

35. The method of claim 33, wherein the additional information includes information regarding selectable objects which are animated in the training animation sequence and the information is displayed when the object is selected by a user viewing the training animation sequence.

36. The method of claim 33, wherein the additional information includes items of instructional information, each item of instructional information corresponding to a portion of the training animation sequence.

37. The method of claim 30, wherein the training animation sequence includes moving representations of an animated person.

38. The method of claim 37, wherein the animated person has the same characteristics as the live person.

39. The method of claim 30, wherein the training animation sequence includes a plurality of views, each from a different viewpoint.

40. The method of claim 30, wherein the training animation sequence is stored in a database.

41. The method of claim 30, wherein the training animation sequence may be distributed to and accessed by a user.

FIGURE 1

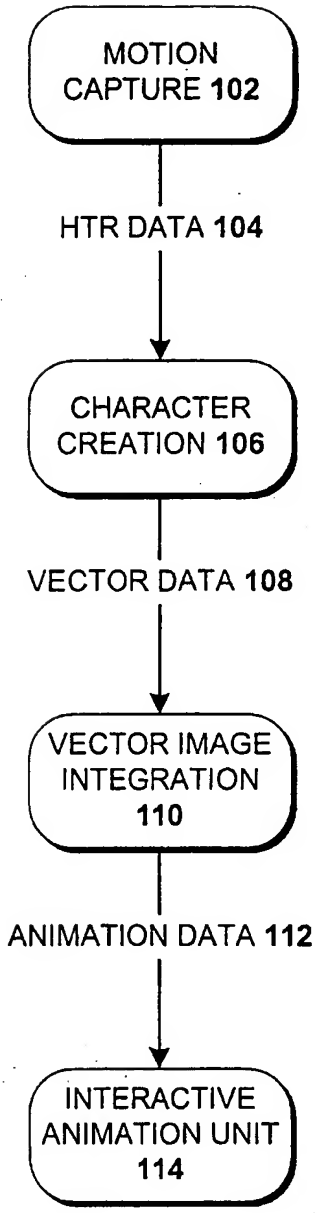

MOTION CAPTURE 102
HTR DATA 104
CHARACTER CREATION 106
VECTOR DATA 108
VECTOR IMAGE INTEGRATION 110
ANIMATION DATA 112
INTERACTIVE ANIMATION UNIT 114

FIGURE 2A

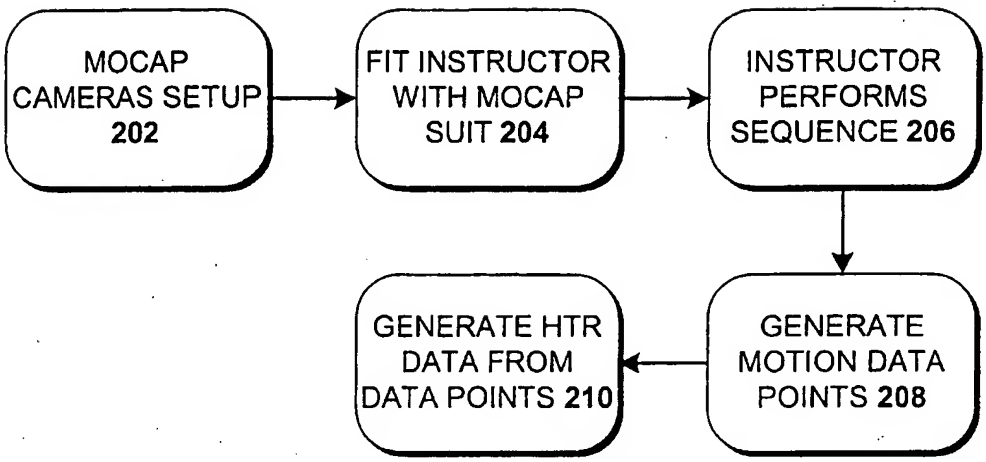


FIGURE 2B

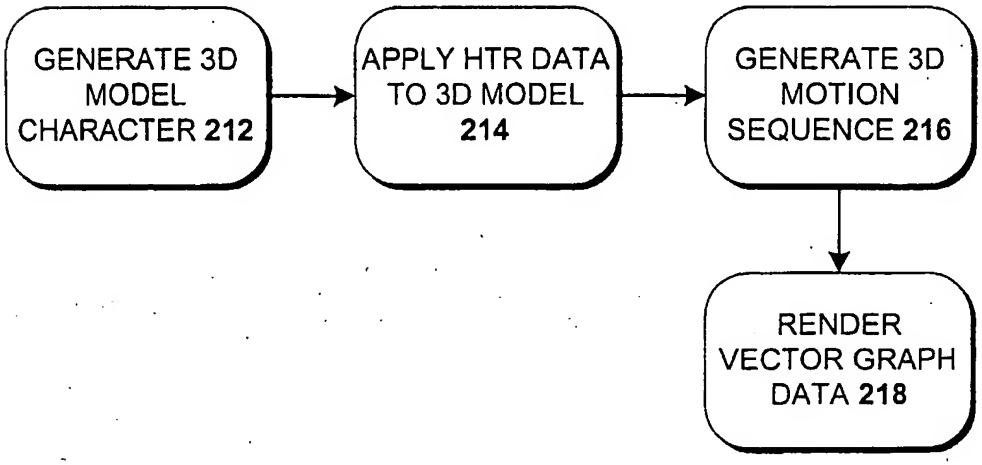


FIGURE 2C

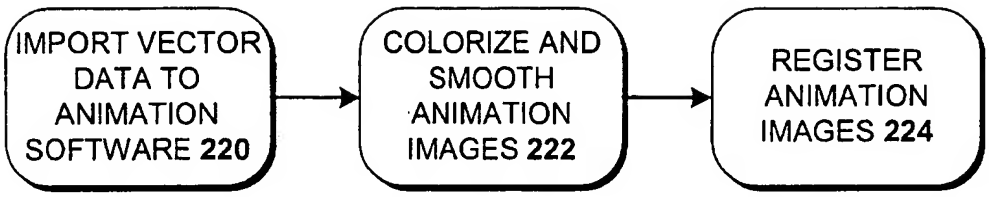


FIGURE 2D

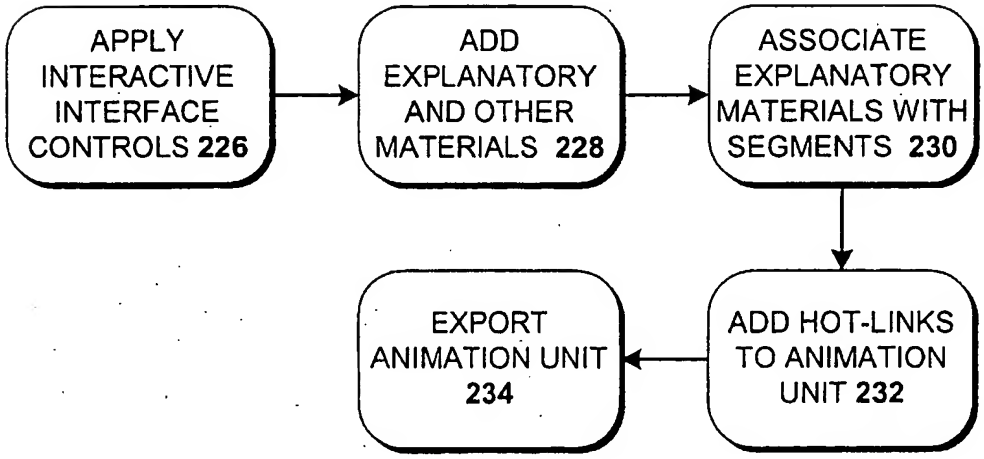


FIGURE 3

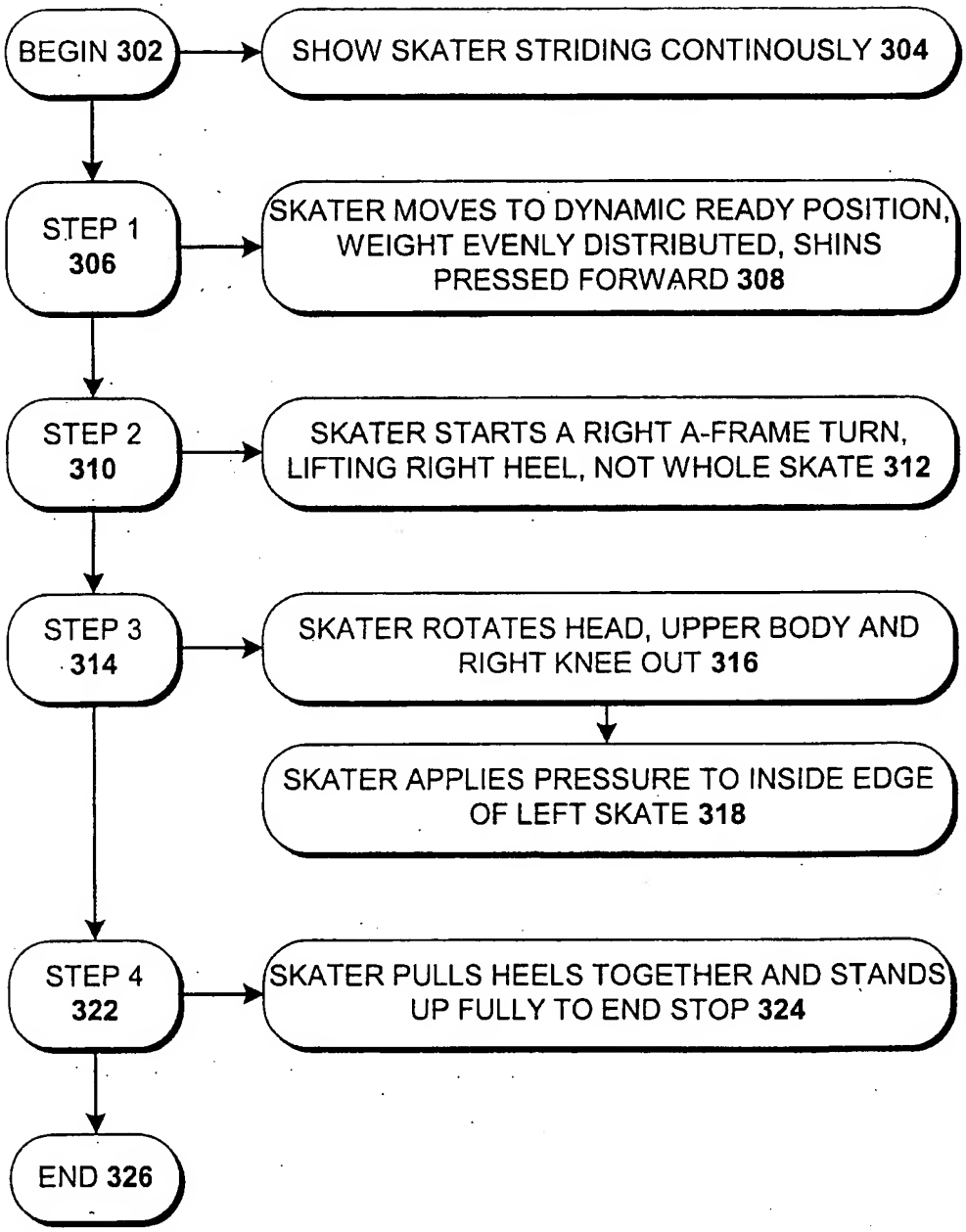

BEGIN 302
SHOW SKATER STRIDING CONTINOUSLY 304
STEP 1 306
SKATER MOVES TO DYNAMIC READY POSITION, WEIGHT EVENLY DISTRIBUTED, SHINS PRESSED FORWARD 308
STEP 2 310
SKATER STARTS A RIGHT A-FRAME TURN, LIFTING RIGHT HEEL, NOT WHOLE SKATE 312
STEP 3 314
SKATER ROTATES HEAD, UPPER BODY AND RIGHT KNEE OUT 316
SKATER APPLIES PRESSURE TO INSIDE EDGE OF LEFT SKATE 318
STEP 4 322
SKATER PULLS HEELS TOGETHER AND STANDS UP FULLY TO END STOP 324
END 326

FIGURE 4A

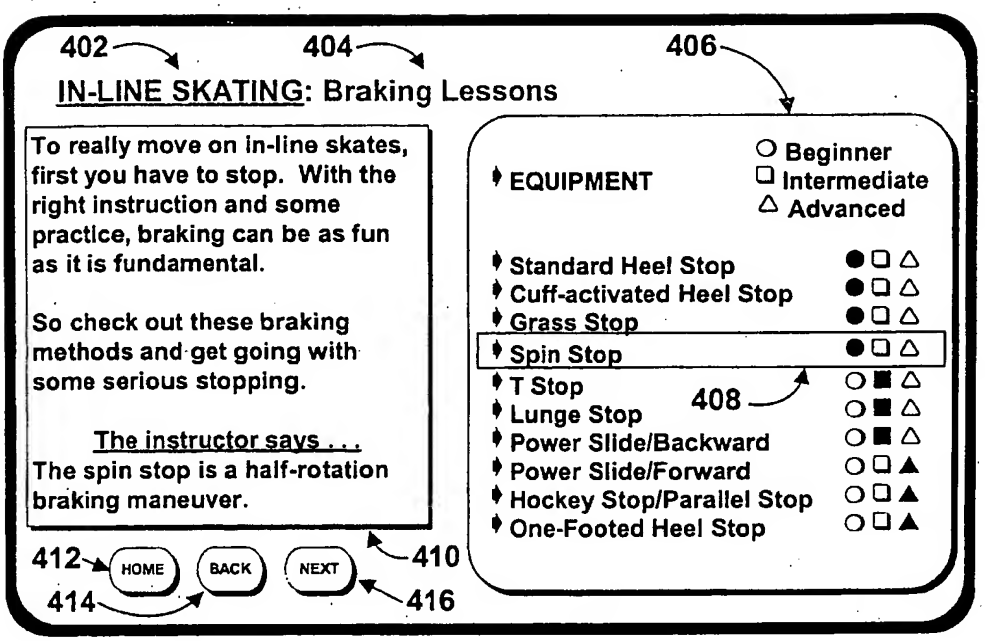


FIGURE 4B

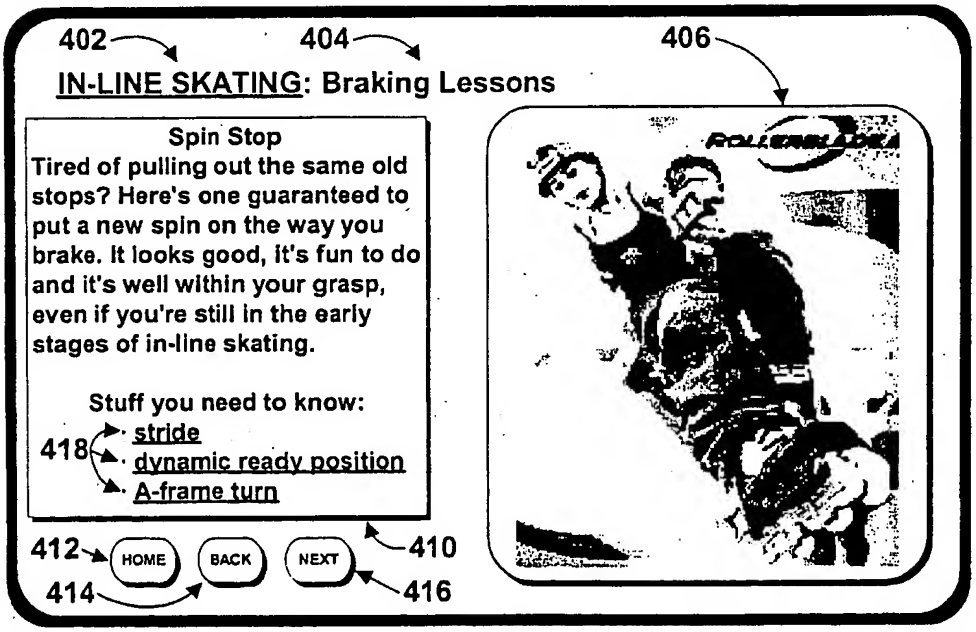


FIGURE 5A

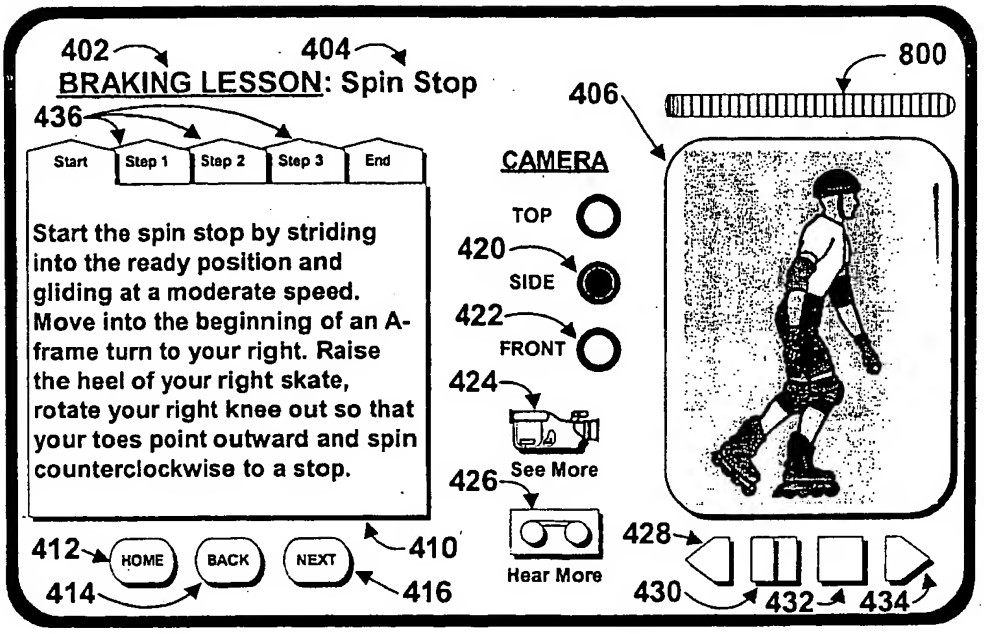


FIGURE 5B

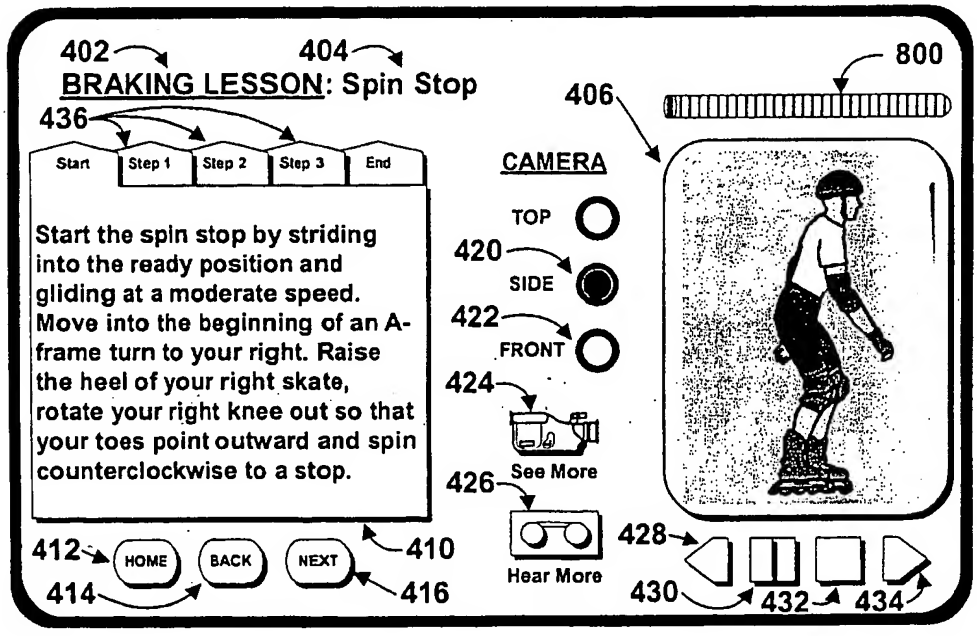


FIGURE 5C

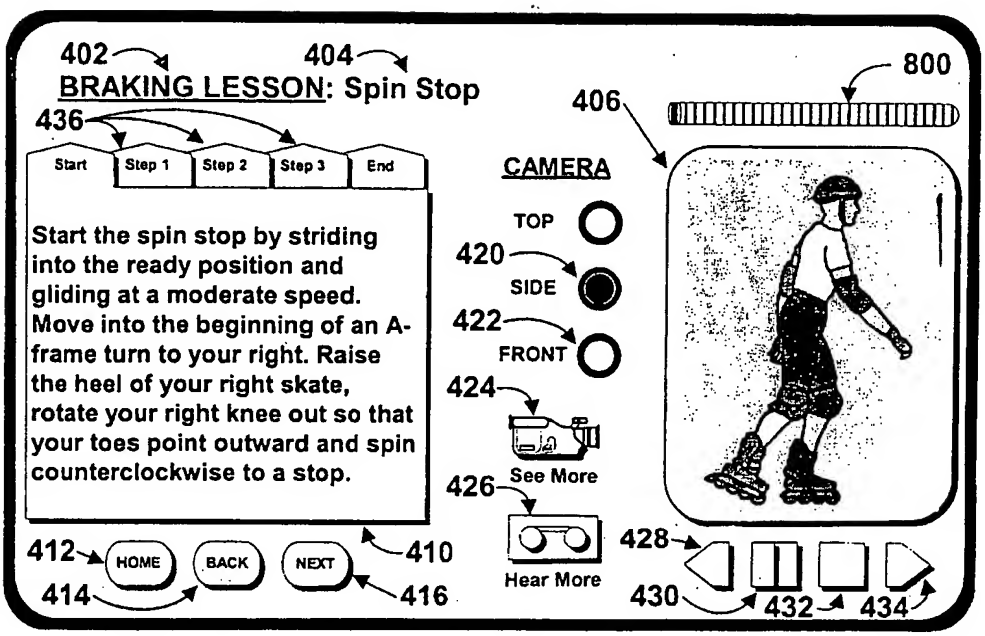


FIGURE 6

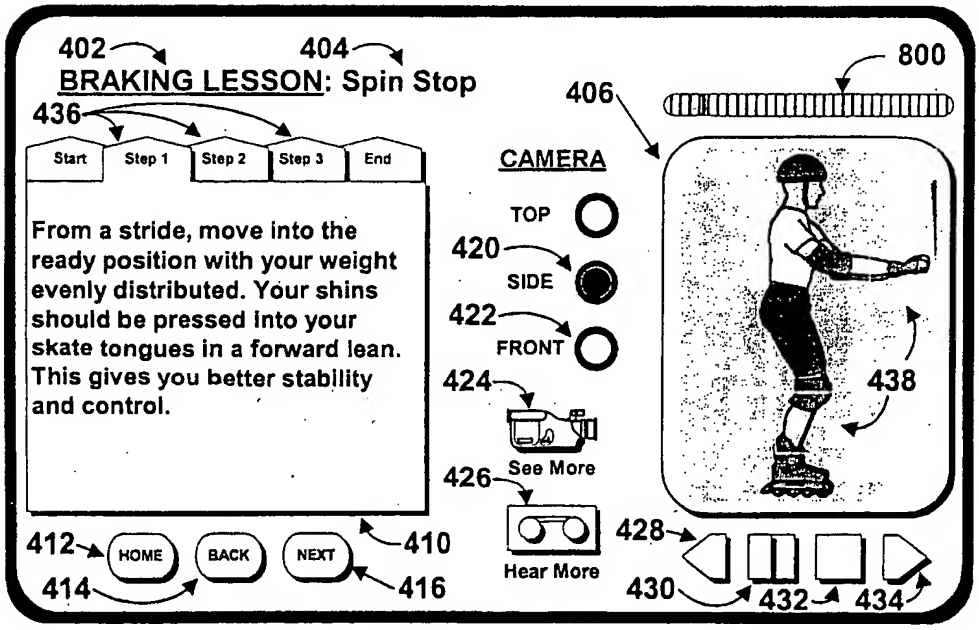


FIGURE 7A

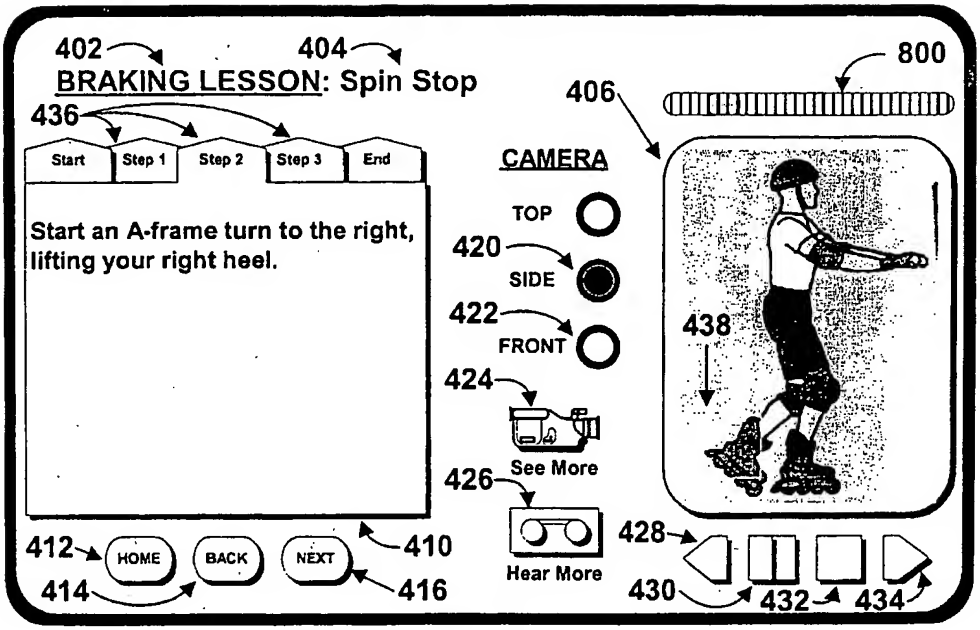


FIGURE 7B

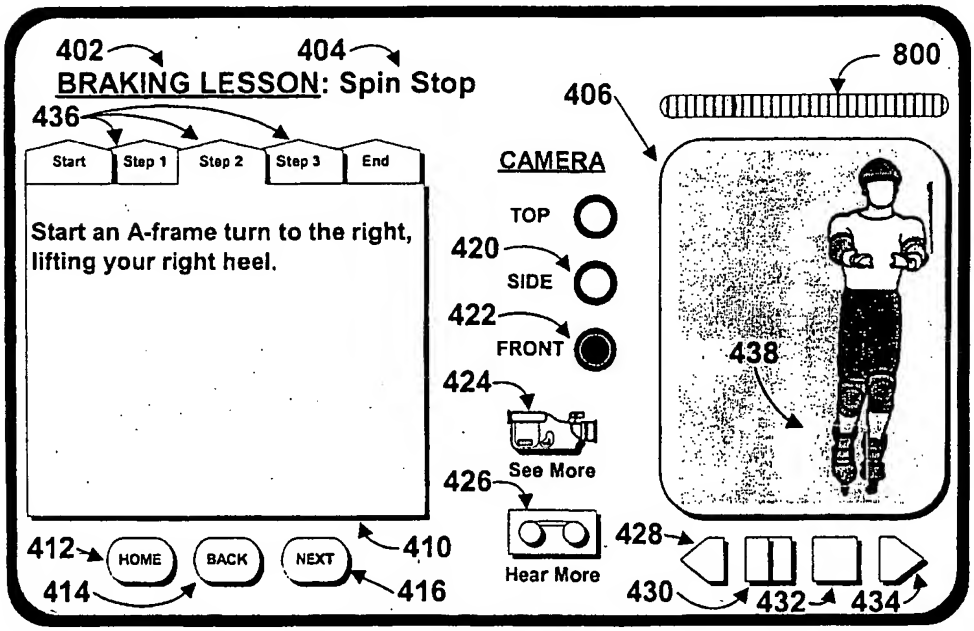


FIGURE 8C

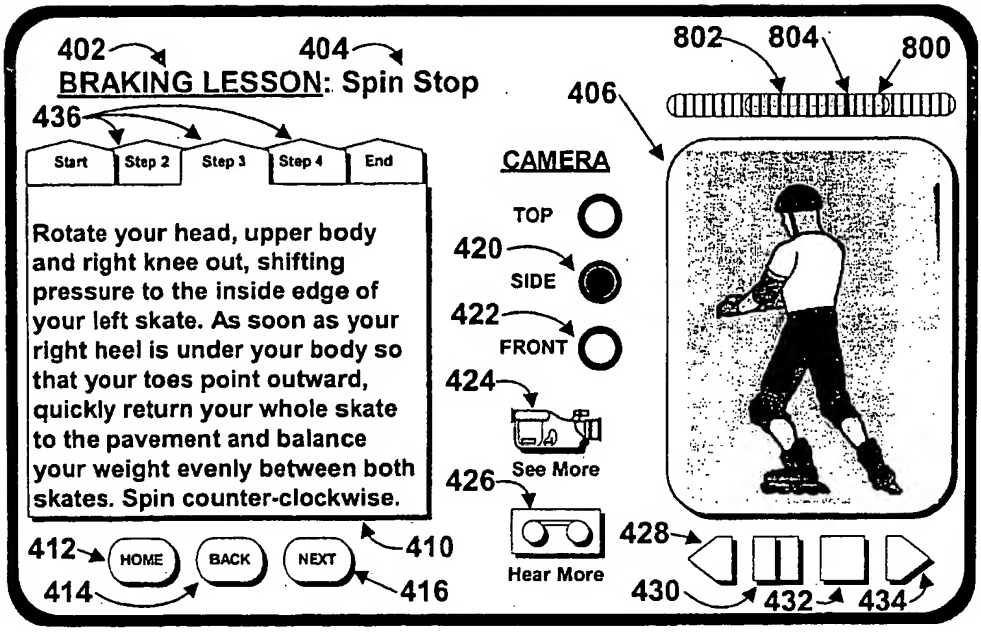


FIGURE 8D

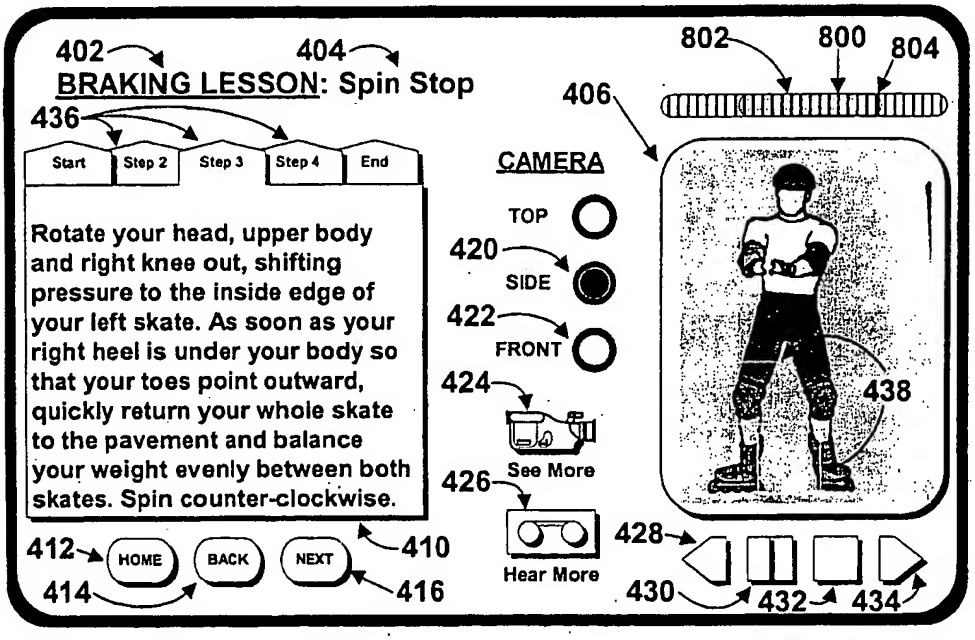


FIGURE 8E

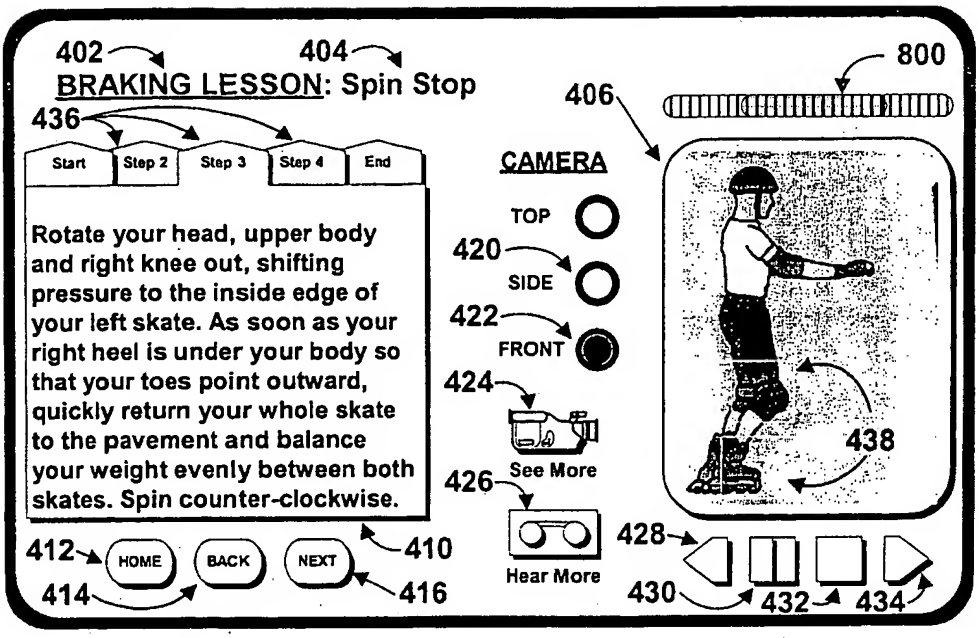


FIGURE 9A

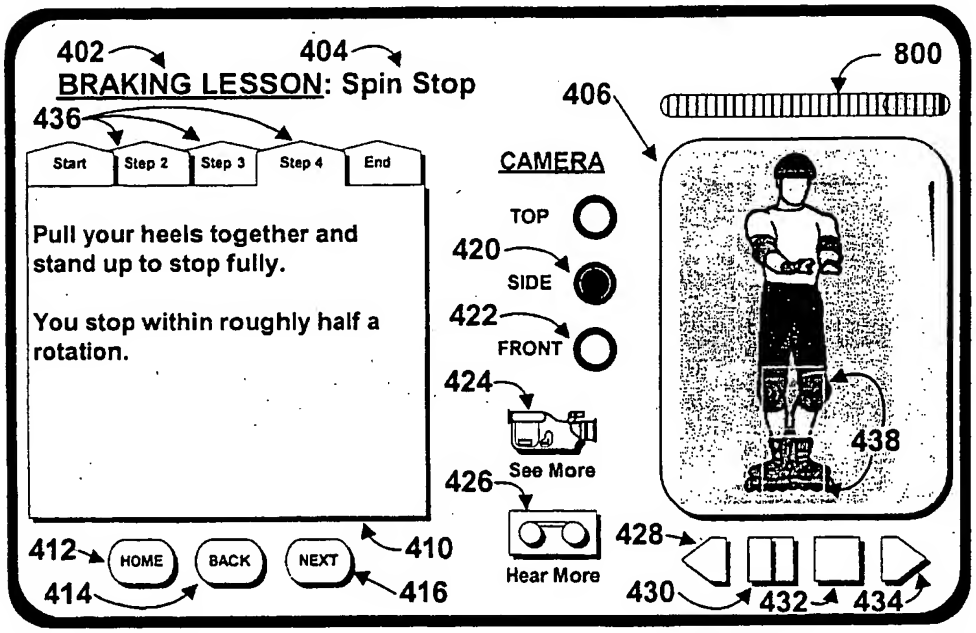


FIGURE 9B

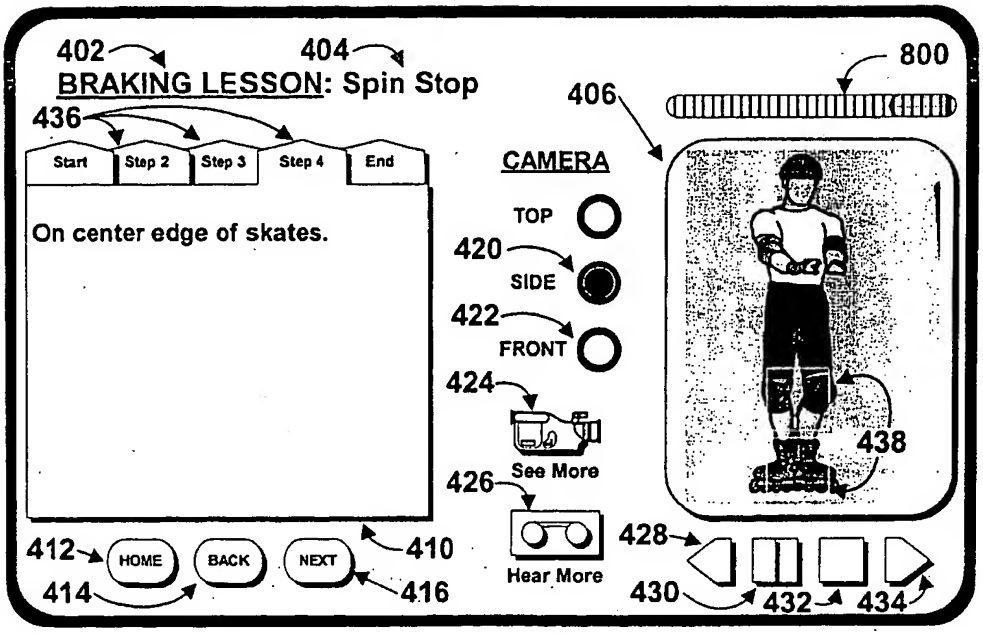


FIGURE 9C

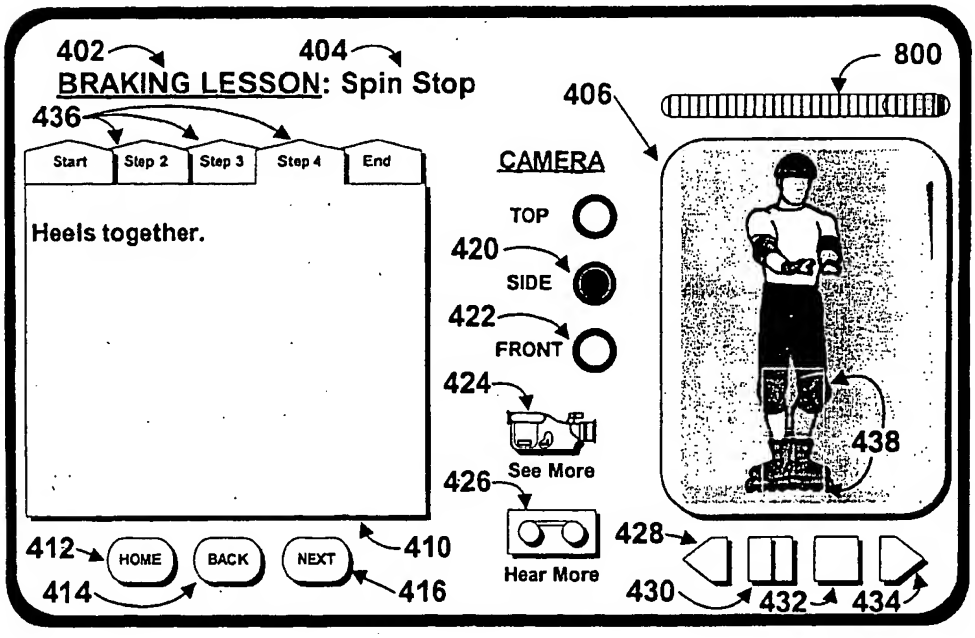


FIGURE 10A

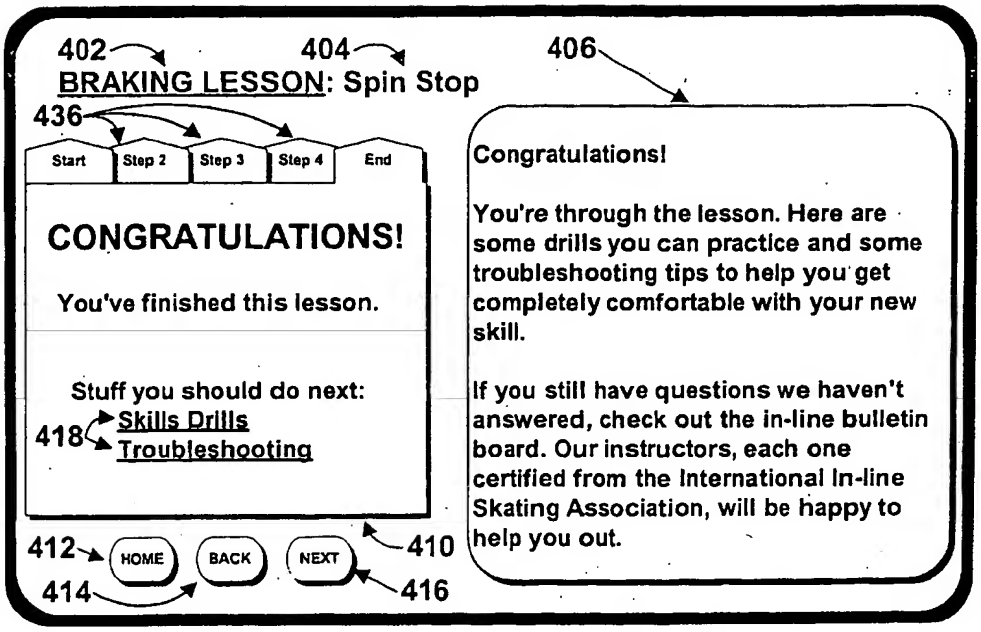


FIGURE 10B

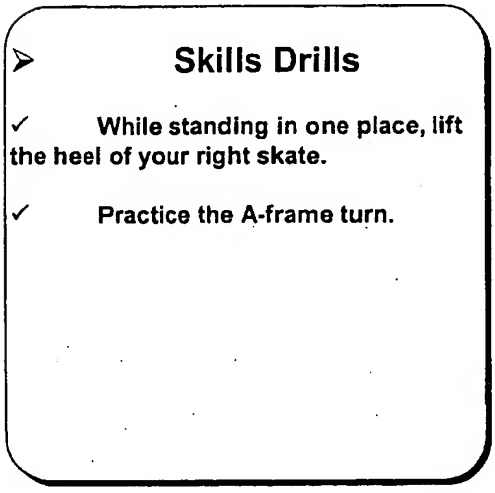


FIGURE 10C

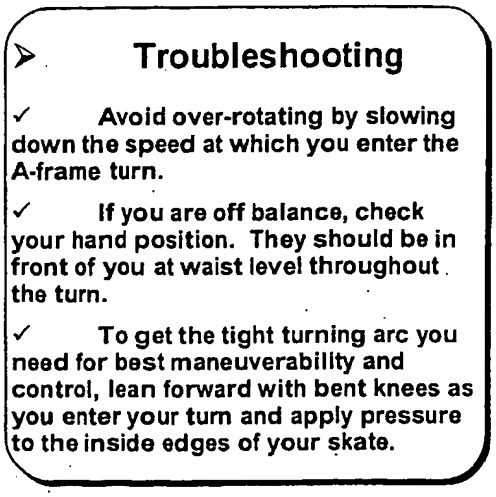


FIGURE 11A

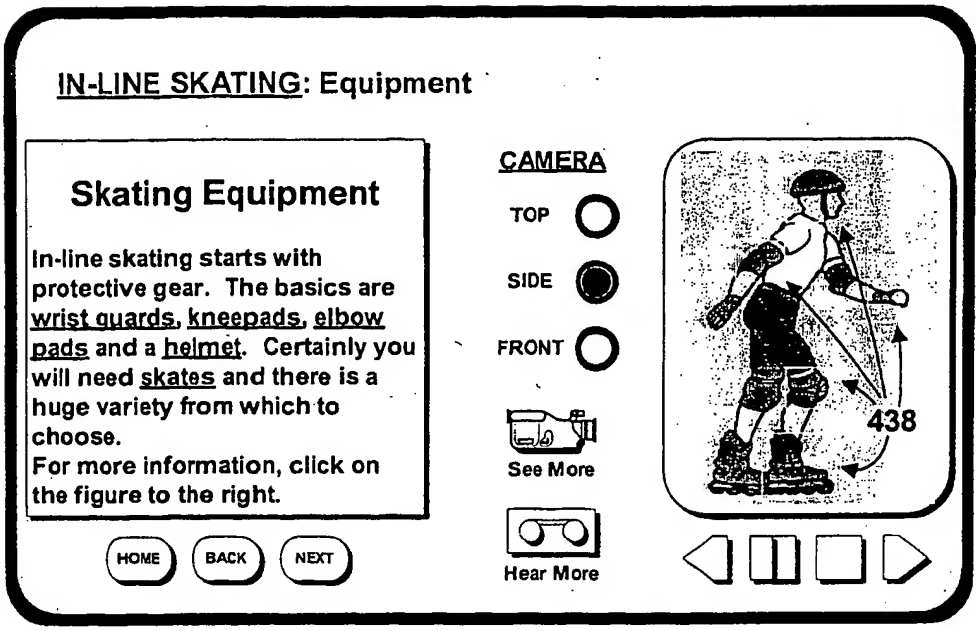


FIGURE 11B

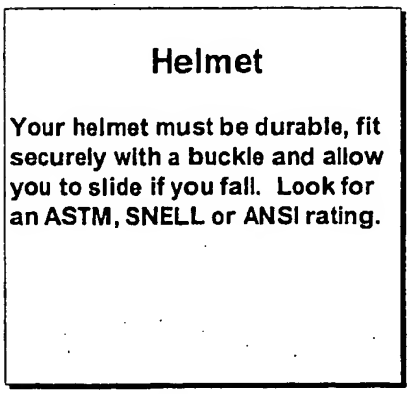


FIGURE 11C

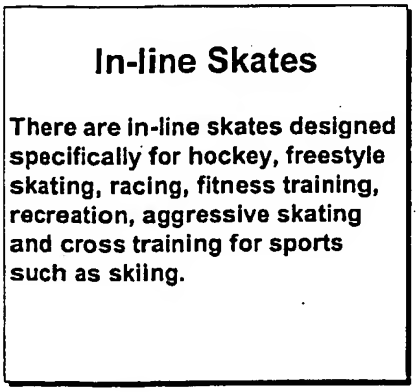


FIGURE 12

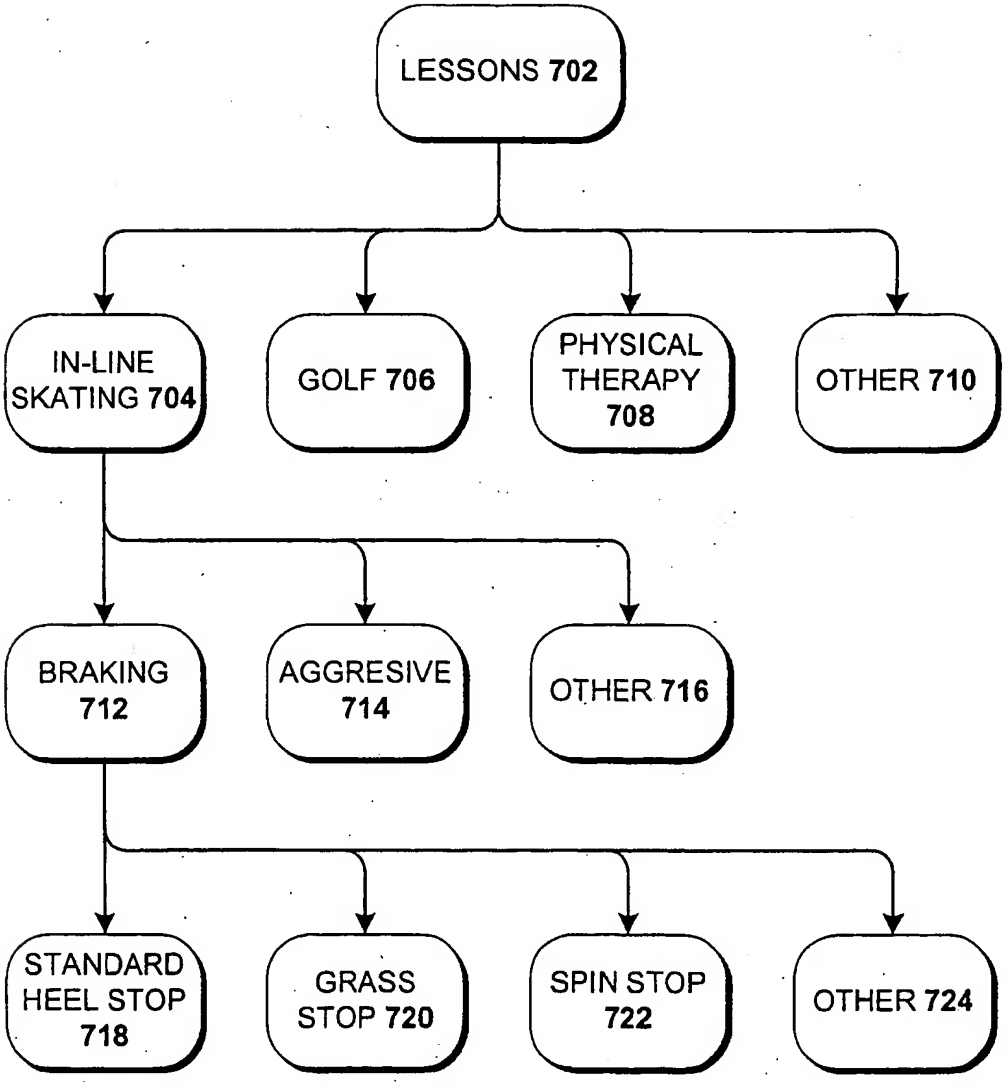
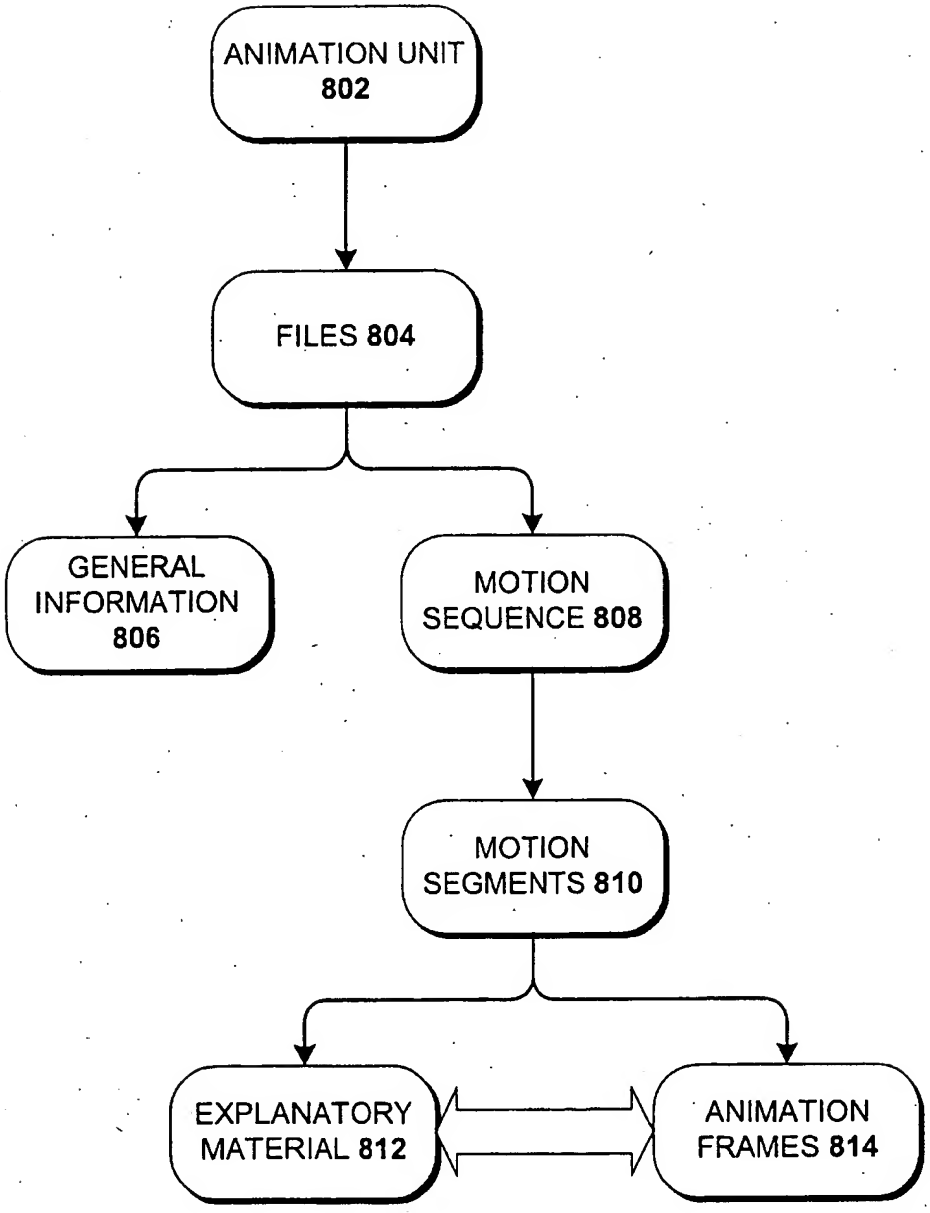

LESSONS 702
IN-LINE SKATING 704
GOLF 706
PHYSICAL THERAPY 708
OTHER 710
BRAKING 712
AGGRESIVE 714
OTHER 716
STANDARD HEEL STOP 718
GRASS STOP 720
SPIN STOP 722
OTHER 724

FIGURE 13


ANIMATION UNIT 802
FILES 804
GENERAL INFORMATION 806
MOTION SEQUENCE 808
MOTION SEGMENTS 810
EXPLANATORY MATERIAL 812
ANIMATION FRAMES 814

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(74) Agents: ABRUZZESE, Peter et al.; Kramer Levin Naftalis & Frankel LLP, 919 Third Avenue, New York, NY 10022 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

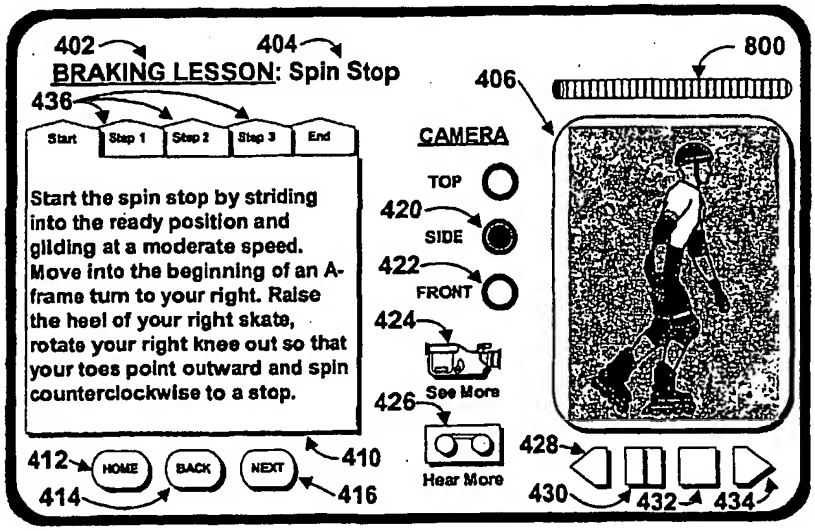
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

(88) Date of publication of the international search report:
10 May 2001

[Continued on next page]

(54) Title: METHOD AND SYSTEM FOR INTERACTIVE MOTION TRAINING



(57) Abstract: The invention employs digitized animation motion sequences to provide training in the performance of a physical activity utilizing a computer-based interactive user-interface. The digitized animation motion sequences are moving images of an instructor dynamically performing particular techniques from a pre-written script (410) using motion capture hardware and software. A digitized animation unit contains one or more digitized animation motion sequences condensed into a single software computer data file. In addition to the pre-written script text, the animation unit contains audio (426), static images (406), and one or more different views (420, 422) of the same animation motion sequences. An interactive computer-based user-interface allows a student to display and control different aspects of the animation unit, such as a frame rate of speed and camera views, on a computer connected to a communications network, the Internet, or television, or any hand-held computer communications device.

WO 01/09861 A3

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/20752

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G06T 15/70
US CL :345/473, 475; 434/247
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/473, 475, 328; 434/247

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST, INTERNET

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	VOYETRA TURTLE BEACH, Inc.'s Teach Me Piano (software description), copyright 1996, pp.2,3	1-4, 9-13 --- 5-8, 14-18
X --- Y	ADOBE PREMIERE 3.0 User Guide, pp.54, 138, 211	19-21, 26-32, 37-41 --- 5-7, 14-17
Y --- A	GAVRON ET AL. "How to Use Windows NT 4 Workstation", pp.6-7	8, 18 --- 22-25, 33-36

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search 20 OCTOBER 2000	Date of mailing of the international search report 01 MAR 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer MARK K. ZIMMERMAN Telephone No. (703) 305-9798

Form PCT/ISA/210 (second sheet) (July 1998)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/20752

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/20752

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

1. This International Search Authority has found two inventions claimed in the International Application covered by the claims indicated below:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, consisting of claims 1-18, is drawn to providing instruction for the performance of a physical activity to a user via computer-based animation.

Group II, consisting of claims 19-41, is drawn to the creation of a computer-based animation unit.

and it considers that the International Application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reasons indicated below:

The inventions listed as Groups I and II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features. The special technical feature of the Group II invention is the process of creating computer-based animation units, while the special technical feature of the Group I invention is the manipulation of a computer-based animation unit for the purpose of providing training. Since the special technical feature of each group is not present in the other group, unity of invention is lacking.
is the providing of education

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/01158

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 7/548

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 G06F, G01P

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)
KIPONET, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 1-131430 A(FUJI ELECTRIC CO LTD.) 24 May 1989 see abstract; figure 1	1,2
Y	JP, 4-191607 A(KABISHIKI KAISHA TOSHIVA) 9 July 1992 see abstract; figure1	1,2
A	US, 5546189 A 13 August 1996 see abstract figure 6	1,2
A	US, 6041652 A(LITTON SYSTEMS INC.) 10 November 1991	1,2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 JANUARY 2001 (31.01.2001)	31 JANUARY 2001 (31.01.2001)

Name and mailing address of the ISA/KR	Authorized officer
Korean Industrial Property Office Government Complex-Taejon, Dunsan-dong, So-ku, Taejon Metropolitan City 302-701, Republic of Korea Facsimile No. 82-42-472-7140	CHO, Ji Hun Telephone No. 82-42-481-5992